



INVESTMENT PROMOTION UNIT TUNISIA

SECTOR OF RENEWABLE ENERGY SOURCES



April 2002

Abbreviations

NARES: National Agency of Renewable Energy Sources

ECA: Energy Control Energy (currently called NARES)

UNTCC: United Nations Treaty on Climatic Changes

SWH: Solar Water Heaters

TCEET: Technical Centre of Engineering and Electrical Industries

ICETT: International Centre of Environment Technologies of Tunis

RE: Renewable Energy Sources

WEF: World Environment Funds

NISTR: National Institute of Scientific Technical Research

MCD: Mechanism for Clean Development

MELP: Ministry of the Environment and Land Planning

MSRT: Ministry of Scientific Research and Technology

UNIDO: United Nations Industrial Development Organisation

KP: Kyoto Protocol

PV: Photovoltaic

IPU: Investment Promotion Unit

TEGC: Tunisian Electricity and Gas Company

TOE: Ton Oil Equivalent

VAT: Value Added Tax

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1. INTRODUCTION

During the last decade, the government's development policy focused on three major concerns:

- Energy concerns

Since the early 1990's, the energy sector in Tunisia has been characterised by a great tendency towards an imbalance of energy sources. In fact, currently Tunisia has moved from an energy surplus of 1.5 Mtep in 1990 to a hardly balanced situation.

In the coming years, the gap between domestic offer and local demand is going to widen up. This is due to the natural decline of the two main oil fields of EL BORMA and ASHTART on the one hand, and to the fast-growing energy consumption on the other hand. Thus, it is expected that the energy shortfall shall reach approximately 8 Mtep by the year 2010¹.

- Environmental concerns

As far as the environment is concerned, the 1990's have been characterised by the international community's growing concern over the issues of global warming due to greenhouse gas release, essentially of an energetic origin.

These concerns have been confirmed through the adoption of the United Nations Treaty on Climatic Changes (UNTCC) following the Rio Conference in 1992.

Ever since, international negotiations have been launched to reduce greenhouse gas release. That led to the Kyoto Protocol as well as to different negotiation rounds working to its implementation.

As a signatory to the Treaty since 1993, Tunisia is looking forward to signing the Kyoto Protocol in the coming months and is firmly committed in the world dynamics. Similarly to other developing countries, Tunisia's involvement is not that binding as far as the reduction of greenhouse gas is concerned. However, adopting a policy in that area is twice as worthy since it:

- ? helps the country get ready for possible future commitments which international negotiations might impose on developing countries.
- ? capitalizes on the new opportunities as well as financing possibilities set for developing countries within the framework of the protocol.

- Economic and social concerns

The population's economic and social development has been the country's main line of policy for about ten years. Thus, job creation for the young together with the improvement of living conditions of the poor sections of the population, have always been given priority by the State.

Aware of this situation, the Tunisian government is trying to make the most of every single opportunity likely to contribute to the achievement of these targets. The development of renewable energy sources represents one of the opportunities that may give an answer to the three concerns.

Indeed, renewable energy sources contribute to the reduction of the expected national energy imbalance through potential energy savings. From the environmental point of view, the use of renewable energy sources on a large scale is the best way to contribute to the protection of global environment, by reducing greenhouse gas releases. The development of renewable energy sources will also enable Tunisia to take advantage of the financing opportunities planned within the framework of international agreements on climatic changes.

Economically and socially speaking, besides the reduction in the energy bill as well as foreign currency savings, the development of energy sections can have a huge economic impact such as creation of new jobs, integration and the growth of the industrial added value.

Renewable energy sources are also viewed by the Tunisian government as a way of improving living conditions of the poor sections of the population, notably those living in remote rural areas. That would be done through electrification and photovoltaic pumping projects, public showers equipped with solar water-heaters, biogas, the development of biomass and so on.

For all the different reasons mentioned above, the sector of renewable energy sources represents a profitable market for both native and foreign investors. Accordingly, this report has been drawn up within the framework of sectoral activities regarding “Environment and Energy” of the Investment Promotion Unit of UNIDO, with the purpose of:

- ? introducing the sector to foreign operators and investors (especially Italian ones) interested in the Tunisian market,
- ? Promoting industrial partnerships between Italian and Tunisian companies in this sector.

In order to achieve the targets mentioned above, IPU launched a sectoral action in 2001 which consists in:

- ? carrying out an analysis to be published in both French and Italian , providing an identification of investment opportunities,
- ? elaborating a portfolio of projects to be promoted,
- ? identifying Tunisian companies interested in a partnership with Italian ones,
- ? identifying Italian companies interested in a partnership with Tunisian ones,
- ? realising a workshop-seminar which would allow Tunisian and Italian companies involved in the sector of renewable energy sources, to meet together to consider partnership opportunities.

2. THE INSTITUTIONAL FRAMEWORK OF ENERGY SOURCES IN TUNISIA

Ever since the early 1980's, Tunisia set up an institutional framework promoting energy control, particularly regarding renewable energy sources.

The institutional organisation is made up of NARES which is the basic element of this organisation, and of a few organisms that are involved in the implementation of energy control.

2.1 The National Agency of Renewable Energy Sources (NARES)

The National Agency of Renewable Energy Sources (NARES), previously called (ECA), was created in 1985 and currently represents the principal institutional tool for the making and implementation of the government's policy in this field. Its role covers a wide field of action, namely:

- ? elaborating adequate programmes encouraging a rational use of energy and the development of renewable energy sources,
- ? elaborating institutional, legal, and financial mechanisms aiming at promoting a rational use of energy and at developing renewable energy sources,
- ? seeking investment projects related to energy control in particular those benefiting from specific existing assistance mechanisms and ensuring their follow up,
- ? achieving pilot projects and demonstration ones aiming at the most promising energy sections,
- ? carrying out prospective and retrospective studies relative to the analysis of energy demand and to the impacts of energy control programmes,
- ? organising awareness campaigns and trainings in the field of energy control.

NARES is supervised by the Ministry of the Environment and Land Planning (MELP) with 2 technical departments: Renewable Energy Sources organised into sections, and Rational Use of Energy Sources, organised into sectors of activity.

2.2 Other institutions involved in the sector

Among other institutions involved in the sector of energy control, are the following:

? The Ministry of Environment and Land Planning (MELP)

The latter intervenes in the planning and management of the sector dealing with Renewable Energy Sources throughout NARES which it supervises. MELP also supervises the International Centre of Environment Technologies in Tunis. This latter one is particularly in charge of information, training, and popularisation of techniques and clean technologies.

? The Prime Minister's Office

The National Committee of Energy Control is supervised by the Prime Minister's Office. The coordination of the different sub-committees' work is done by MELP through NARES.

? **The Ministry of Scientific Research and Technology (MSRT)**

The National Institute of Scientific and Technical Research (NISTR), is located in BORJ CEDRIA, in the suburbs of Tunis. It is responsible to the Ministry of Scientific Research and Technology (MSRT). Among its various tasks, NISTR is in charge of the development of alternative energy sources.

? **The Ministry of Industry**

The Ministry of Industry includes an Energy Department which basically deals with energy policies. It supervises the Tunisian Electricity and Gas Company (TEGC) as well as the Technical Centre of Engineering and Electrical Industries (TCEEI).

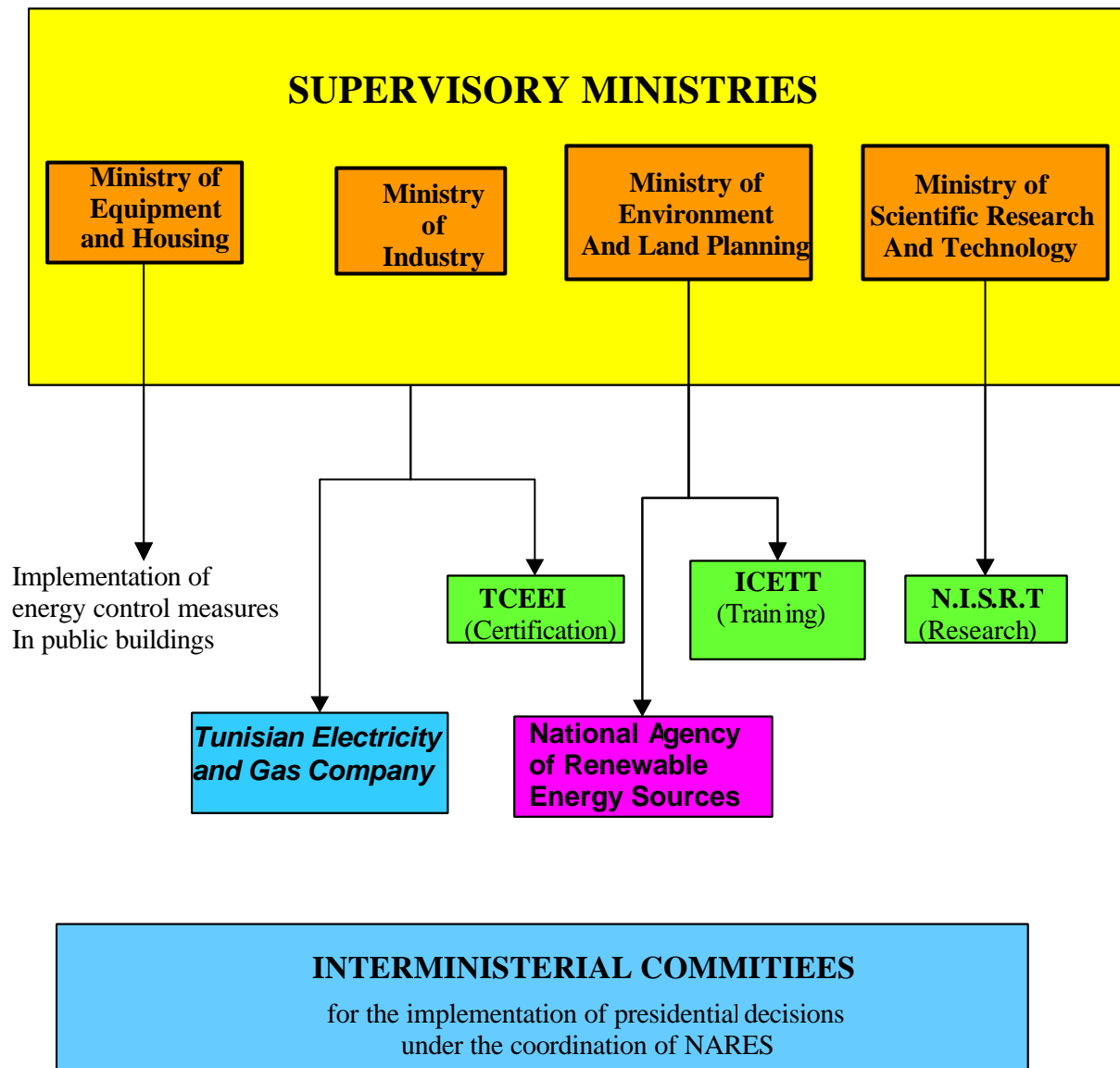
- TCEEI intervenes notably in the certification of energy equipment. This is performed within the framework of its larger mission of technical support to national industry.
- TEGC is a state-owned company in charge of electric power production, transport and distribution as well as the transport and distribution of natural gas. This company is also interested in the development of renewable energy sources, notably wind power. It has already created a 10-MW park in SIDI DAOUD (CAP BON), the first of its kind, and has launched a project to double extend it.

? **The Ministry of Equipment and Housing**

The Ministry of Equipment and Housing is in charge of integrating energy control in the building trade code.

The above-mentioned institutional framework is drawn in a diagram in **figure 1**.

Fig. 1- Institutional Framework



3. THE STATUTORY FRAMEWORK OF ENERGY SOURCES IN TUNISIA

3.1 Laws

The legislative and tax framework, relative to the promotion of energy control in general and to renewable energy sources in particular, is basically run by the following laws and decrees:

- Law 90-62, of July 24, 1990 relative to energy control
- Law 93-120 of December 27, 1993, relative to the investment code
- Implementation Decree n° 87-50 of January 13, 1987, creating mandatory and periodic audit missions
- Implementation Decree n° 87-51 of October 13, 1987 requiring prior consultation of the Energy Control Agency as far as high-energy-consuming projects are concerned.

- Implementation Decree n° 94-537 of March 10, 1994, setting amounts and conditions of granting a specific financial incentive to investments in the field of energy control.
- Implementation Decree n° 94-1191 of May 30, 1994, setting conditions to benefit from tax incentives stated in articles 37- 41- 42 and 49 of the Investment Promotion Code.

3.2 Legal obligations

In terms of obligation, the legislative framework makes provision for the following terms:

- The setting up of any high-energy-consuming project has to be submitted to NARES for prior notice. The latter has to assess the project's energy effectiveness and if necessary, provide some modifications likely to improve it.
- High-energy-consuming organisations are liable for periodic audits. These organisations are the following:
 - ? Organisations belonging to the industrial sector and whose total energy consumption is equal or superior to 1,000ton oil equivalent.
 - ? Organisations belonging to the transport sector and whose total energy consumption is equal or superior to 500ton oil equivalent.
 - ? Organisations belonging to the tertiary sector and whose total energy consumption is equal or superior to 500 ton oil equivalent.

3.3 Advantages and incentives

According to this framework, incentives granted for the promotion of energy control are the following:

- A 20% assistance of the cost of energy audit limited to a maximum of 20,000 dinars.
- Assistance granted to demonstration projects, set to 50% of the project's global cost, and limited to a maximum of 100,000 dinars.
- Assistance to investments in the rational use of energy and renewable energy sources, set to 20% of the investment global amount, and limited to a maximum of 100,000 dinars.
- Investments aiming at achieving energy efficiency and developing research, production and marketing of renewable energy sources and geothermal power, shall benefit from a reduction in customs duties at a minimum rate of 10%, exemption from VAT on imported equipment and machinery that have no equivalent locally, and exemption from VAT on equipment and machinery purchased on the local market.

3.4 Prospects of the statutory framework

The Presidential decisions announced in May 2001 confirm the Government's commitment to a rational use of energy and to the promotion of renewable energy sources. These decisions

aim at adapting the energy development and control framework from a legal, organisational and financial point of view. The decisions are the following:

1. Establishing an Energy Control Day and a Presidential award to be granted in this matter.
2. Instituting the “Energy-Man” position inside civil service and public organisations.
3. Mobilising necessary financial resources for the support and development of Energy Control.
4. Updating the legal framework relative to Energy Control.
5. General implementation of energy audits and prior consulting by the revision of the liability threshold of energy-consuming organisations.
6. Improvement of financial incentives to encourage Energy Control.
7. Promoting co-generation in the industrial and tertiary sectors.
8. Encouraging energy-service companies to invest in the field of Energy Control.
9. General implementation and decentralization of vehicle-engine diagnoses.
10. Compulsory energy audits prior to the construction of new and large buildings (audit on plan).
11. Sensitising hotel owners to the use of equipment and machinery likely to save energy.
12. Accelerating the completion of transport master plans in large towns (TUNIS, SOUSSE, SFAX).
13. Inciting city councils to carry out energy audits within the premises put under their jurisdiction and to use energetically-effective technologies in the public lighting network.
14. Adopting norms corresponding to limited thresholds of energy consumption for high-energy-consuming electrical household appliances (air-conditioners, refrigerators, electrical ovens, and irons).
15. Encouraging the use of electric power outside of peak hours.
16. Increasing natural gas contribution to energy consumption in different sectors.
17. Compulsory use of solar water-heaters in new public buildings.
18. Compulsory exploitation of photovoltaic energy in different fields.
19. Developing the use of wind power in the production of electricity.
20. Incitement to energetic valorisation of waste, geothermal waters, waterfalls and gases related to oil production.

The implementation of these Presidential decisions will certainly result in a reform of the legal framework and the promulgation of the related laws and decrees. An interministerial committee has already been given the responsibility of suggesting an adequate legislative framework so as to implement the above- mentioned decisions. The new legislative tools shall probably come into force in the course of the year 2002.

4. RESULTS AND PROSPECTS OF RENEWABLE ENERGY SOURCES IN TUNISIA

4.1 Achievements²

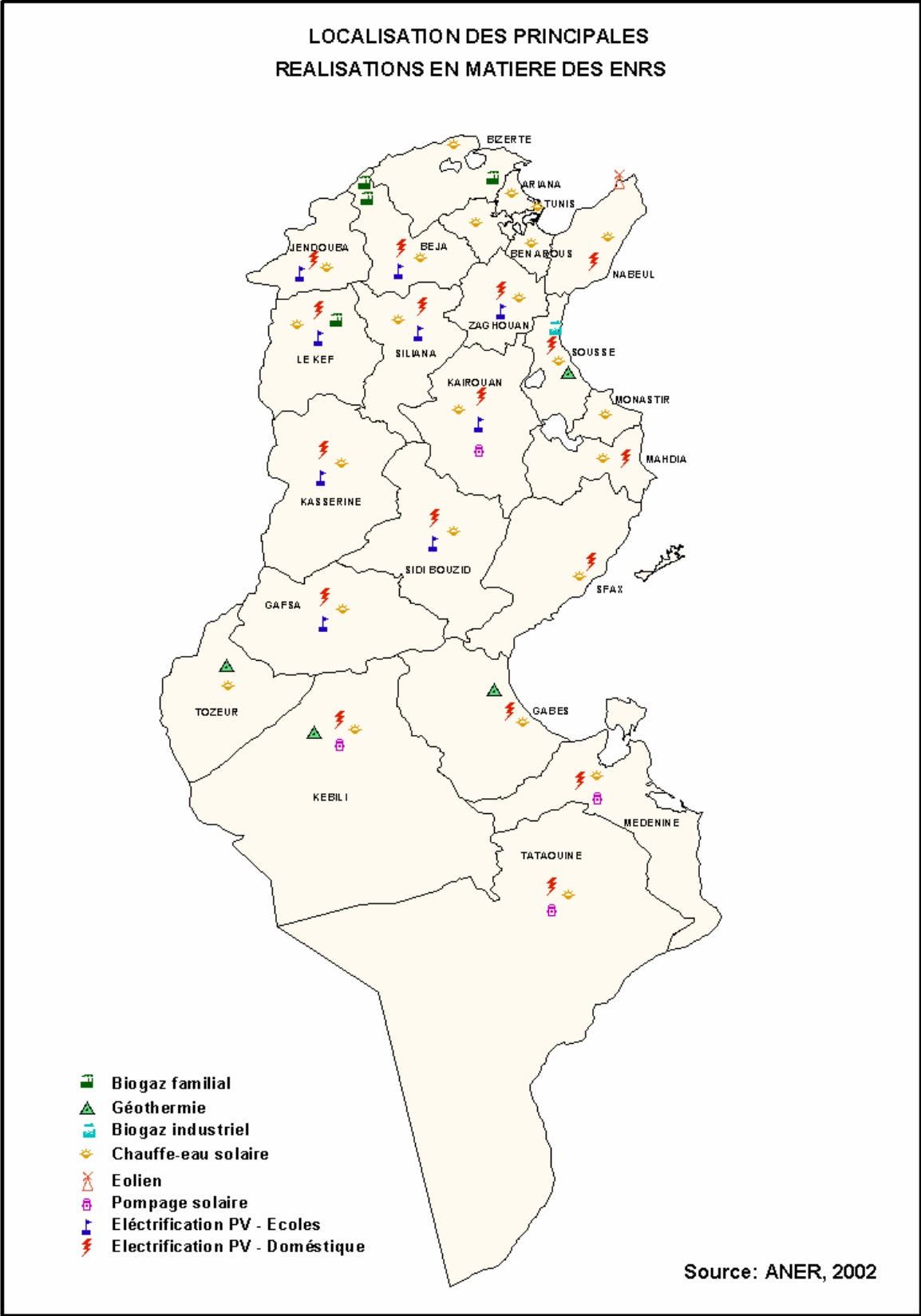
The principal achievements in the field of renewable energy sources during the last decade are the following:

- Use of photovoltaic systems to supply electrification for approximately 10,000 homes and schools in rural areas, and the equipment of about 20 pumping stations and border centres with these systems.
- Installation of solar cells over a 60,000 m² area, for the heating of sanitary water in residential and tertiary sectors.
- Testing the use of animal excrement-produced biogas among 50 family homes and one industrial unit.
- Installation of a 10-MW-capacity wind power station in the CAP BON area.
- Distribution of 10,000 lids for home-made bread baking to reduce wood consumption.

In spite of the achieved results, the assessment of actions in the field of renewable energy sources as well as in the rational use of energy, shows that the contribution to energy control is still limited (less than 5%) in Tunisia. This is basically due to the following reasons:

- Very high costs of certain sections of energy effectiveness and renewable energy sources.
- The current low prices of conventional energy sources which remain well below international prices.
- Insufficient assistance and incentives.
- Absence of an adequate institutional and statutory framework allowing a large-scale diffusion of certain mature technologies.
- Very limited equipment markets preventing from taking advantage of scale effects, and development on a commercial basis.
- Lack of a valorisation of positive externalities of the rational use of energy and renewable energy sources in terms of protection of the environment and job creation.
- Insufficient information, sensitisation, and promotion among potential public and private users.

“Main Achievements in Renewable Energy Use”



4.2 Prospects

The national strategy for future development of renewable energy sources is based upon the following principal orientations:

- A large-scale distribution of mature technologies into accessible markets, notably the thermal solar one for water heating, and the photovoltaic one for rural electrification.
- Creation of a market favourable to the promotion of renewable energy sources which have witnessed an important development abroad like wind sections and biogas.
- Elaboration of a national strategy regarding Scientific Research, ensuring the development of technologies related to renewable sections so as to reduce costs and improve competitiveness.
- Encouraging the private sector to invest in renewable energy sources in order to develop a local market and create new jobs.

Short and long-term programmes have been set up for the implementation of these orientations.

In the short-term, the presidential decisions mentioned above, shall be carried out to allow the adaptation of the institutional framework and capacity building.

In the long-term, the ten-year programme aims at the development of renewable energy sources on a commercial basis, notably as far as priority sections are concerned, i.e. solar heaters and wind power for electricity production.

The main components of this programme which shall be implemented by 2010, are the following³:

- Electrification of 15,000 to 20,000 homes, which will raise the electrification rate in rural areas to 100%.
- Installation of solar cells over an area of 300,000 m², thus improving the amount of solar energy used in heating sanitary water.
- Installation of 200-MW wind parks, thus increasing the amount of wind power in the electrical production capacity from 0.1% to 6%.
- Development of biogas production on a family and especially on an industrial scale, using organic waste. This will allow a contribution to energy of 100 Ktep.
- A large-scale distribution of lids to homes with improved living conditions, thus allowing energy savings of 300Ktep yearly, starting from 2010.

5. THE MARKET OF RENEWABLE ENERGY SOURCES IN TUNISIA

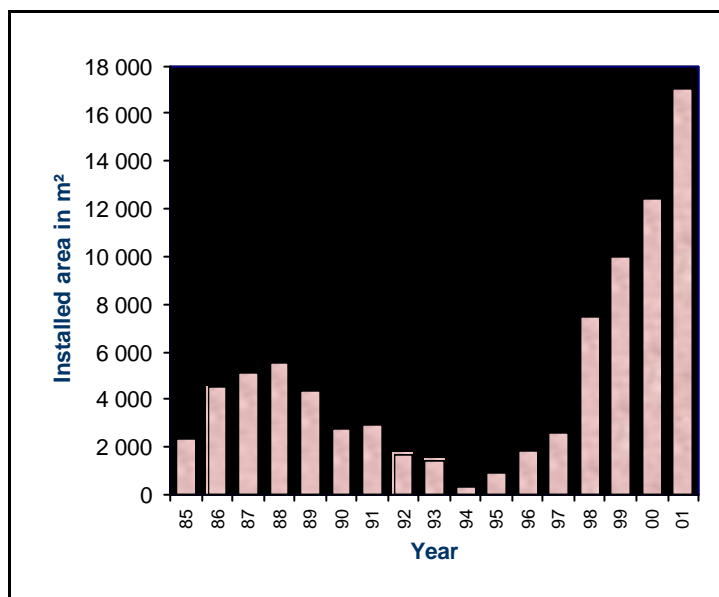
5.1 Solar thermal

5.1.1 The sector's state of development

The first experiments in the distribution of solar heaters in Tunisia date back to the early 1980's when SEN, a public company producing solar water-heaters (SWH), was set up. However, this experience failed due to SWH quality problems.

The solar water-heater market in Tunisia owes its real take-off to the World Environment Fund (WEF), a project financed by both the World Bank and the Kingdom of Belgium (\$7.3 M US), and run by NARES. The project consists in granting a 35% subsidy of the investment cost of SWH in the purpose of making this product more competitive than other systems using conventional energy sources. The project's target is to stimulate the market, overcome financial barriers, namely by trying to reduce the purchase price, and to create a local base of industrialists and operators.

Fig.2 Evolution of SWH's in Tunisia (1985-2001)



Therefore, by the end of 2001, the number of installed SWH is estimated at 60,000 m² of solar cells.

5.1.2 The section's development prospects

The development capacity targeted by the NARES plan of action is 300,000 m² by the year 2010. Nonetheless, the WEF project came to an end in 2002, funds having exhausted well before the due date set by the project (end of 2004). Therefore, local operators shall have to improve the competitiveness of their products in order to attain the development objectives set by the plan of action.

Because Tunisians have become familiarised with technology, and thanks to the current incentives and those that shall follow up the Presidential decisions in this matter, such as the

compulsory use of solar thermal energy in newly-built public buildings, it is very likely that this ambitious target will be achieved.

5.1.3 The industrial and commercial base

The industrial and commercial base of solar water-heaters is the most developed of all renewable sections in Tunisia. This base is essentially composed of 9 companies:

- Three local industrial concerns, the most important of which is the Franco-Tunisian SOFTEN, which holds more than 60% of the local market. It also exports to Morocco.
- Six import companies representing different trademarks.
- A network of engineers throughout the country.
- 500 jobs

5.1.4 Summary table

Achievements	60,000 m ² - solar water-heaters (80% residential – 20% tertiary)
Production	Local / Import (Australia, France, Greece, Spain) 3 companies / 6 importing companies
Potential development capacity of the market	1,000,000 m ²
Potential development capacity of the regional market	5,000,000m ² (Tunisia / Morocco / Algeria)
Reference typologies and sizes of installations required by the market	200 and 300-litre private water-heaters + 1,000 to 2,000-litre public water-heaters Average price: 400Euros/ m ²
Current incentives and/or planned by government	20% for the private sector VAT exemption + Customs (10%) for the rest + other alternatives still under consideration

Source: NARES

5.2 Photovoltaic

5.2.1 The sector's state of development

The development of the photovoltaic solar market in Tunisia is closely linked to electrification of remote rural areas where housing is scattered. Technically speaking, this electrification is generally set up thanks to 100Wc individual photovoltaic systems. From an institutional point of view, this electrification is based upon a public service approach through national plans financed by Government and implemented by NARES.

The first pilot programme was carried out in 1994 with the German cooperation in EL KEF area. So far, about 10,000 rural homes have been equipped with 100Wc systems, used for lighting and the audiovisual (tape-recorders, black and white TV...).

Besides those electrification programmes, there exists a few solar pumping installations, notably in the South of Tunisia.

In total, the installed park is estimated at more than 2 MW: about 1 MWc for rural electrification, approximately 100 KWc for pumping and the remaining amount for the other professional applications.

5.2.2 The section's development prospects

As mentioned above, NARES is planning to provide photovoltaic electrification for about 20,000 rural homes which will not be connected to a conventional electrical network, due to the fact that they are scattered. By integrating the other applications, notably the professional ones and pumping, NARES reckons the available production capacity will be over 15 MWc by the year 2010.

However, in view of the growing number of installations, NARES will certainly be confronted with the growing need for maintenance as well as after-sale services in order to ensure the continuity and durability of the service. This could provide a market for the private sector, on a contract basis.

5.2.3 The industrial and commercial base

The industrial base is composed of 6 companies:

- Three assembling and equipment installation companies importing different trade marks (Isophoton, BP, Siemens, Total Energy, Naps, etc...)
- A company that assembles electronic components (principally ballast and regulators).
- A company for the import and installation of solar pumping.
- Two solar-battery-producing companies, ensuring exportation to Maghrebian countries and Africa.

5.2.4 Summary table

Achievements	? 2MWc (electrification, pumping, professional applications)
Internal or import production	Import – Photovoltaic panels – Inverters, ballast, regulators
Potential development capacity of the market	15 to 20 MWc
Potential development capacity of the regional market	> 500MWc (Tunisia, Algeria, Morocco)
Reference typologies and sizes of installations required by the market	100Wc ? home electrification 300Wc to 400Wc ? rural schools 2 to 3 kW ? water pumping station
Current incentives and/or planned by government	Subsidy >90% electrification Subsidy =20% investment projects

Source: NARES

5.3 Wind

5.3.1 The sector's state of development

The first wind power experiment of powerful electrical production is relatively recent in Tunisia. The first 10 MW pilot wind power station, located in SIDI DAOUD, started producing in the beginning of 2000. It was created within the framework of the TEGC equipment plan, financed by the Spanish company MADE which has representation office in Tunisia.

The exploitation of the park is done by TEGC. A 9MW extension is being created by the same company.

5.3.2 The section's development prospects

In Tunisia, wind capacity is estimated at more than 1,000 MW. Appraisal studies on this capacity are being carried out by NARES whose plan of action schedules the installation of 100 MW during the 10th plan (2002 – 2006) and 200 MW by the year 2010. However, the sector's development will depend on the statutory and institutional framework which shall be set up, especially with regard to the adequate approach to the transfer of concessions (by inviting tenders or by mutual agreement), and exploitation conditions (repurchase rates of electricity by TEGC,...).

A proposal for a statutory framework shall soon be submitted for governmental approval. This framework is meant to attract private investment. Ultimately, this framework should be consolidated by opportunities made possible by the process of international climatic changes (Mechanisms for Clean Development, etc...).

Foreign investors, mainly Americans, have already shown interest in this matter, and are willing to launch projects quite promptly.

5.3.3 The industrial and commercial base

The industrial wind section hardly exists in Tunisia. On the one hand, this is due to the sector's low rate of development (demand), and on the other hand, to the complexity of necessary investments and the complexity of this technology. However, in order to get ready for the development of this market, some consultancy firms are closely working with foreign counterparts and investors that keep up with commercial innovations.

5.3.4 Summary table

Achievements	10 MW
Production	Import
Potential development capacity of the market	> 1,000 MW
Potential development capacity of the regional market	> 5 to 10,000 (Tunisia, Algeria, Morocco)
Reference typologies and sizes of installations required by the market	Machines of 300 KW each (Spain)
Current incentives and/or planned by government	20% of investment cost limited to 100,000 dinars + other customs and tax incentives

Source: NARES

5.4 Biomass

5.4.1 *The sector's state of development*

When biomass was first introduced in Tunisia, it was in the SEJNANE area, in 1982, within the framework of demonstration projects on a family scale, launched by NARES, as part of a cooperation scheme with the German GTZ. The aim of this experiment was to improve the living conditions of scattered rural homes, supply them with an energy source (which would replace kerosene, oil-gas, and wood) and preserve the forest.

After this pilot experiment involving homes only, NARES switched their interest to the use of this technology on an industrial scale. Indeed, in 1999 NARES cooperated with China and set up the first industrial estate for the promotion of biogas and electricity using animal excrement.

5.4.2 *The section's development prospects*

The national production of organic waste is estimated at 30 million tons per annum, 1.5 million of which are household refuse. NARES plans to use organic waste to develop biogas production on a family scale and particularly on an industrial one. This would lead to a contribution to energy production of 100 Ktep by the year 2010.

5.4.3 *Summary table*

Achievements	2 industrial parks (poultry waste + a purification station)
Production	Import: (China + Germany)
Potential development capacity of the market	30 million tons of organic waste/year ? 900 million m ³ biogas/ year
Potential development capacity of the regional market	To be studied
Reference typologies and sizes of installations required by the market	Methanation installations
Current incentives and/or planned by government	20% subsidy (limited to a maximum of 100,000 dinars) + other customs and tax incentives

Source: NARES

5.5 Cogeneration

5.5.1 *The sector's state of development*

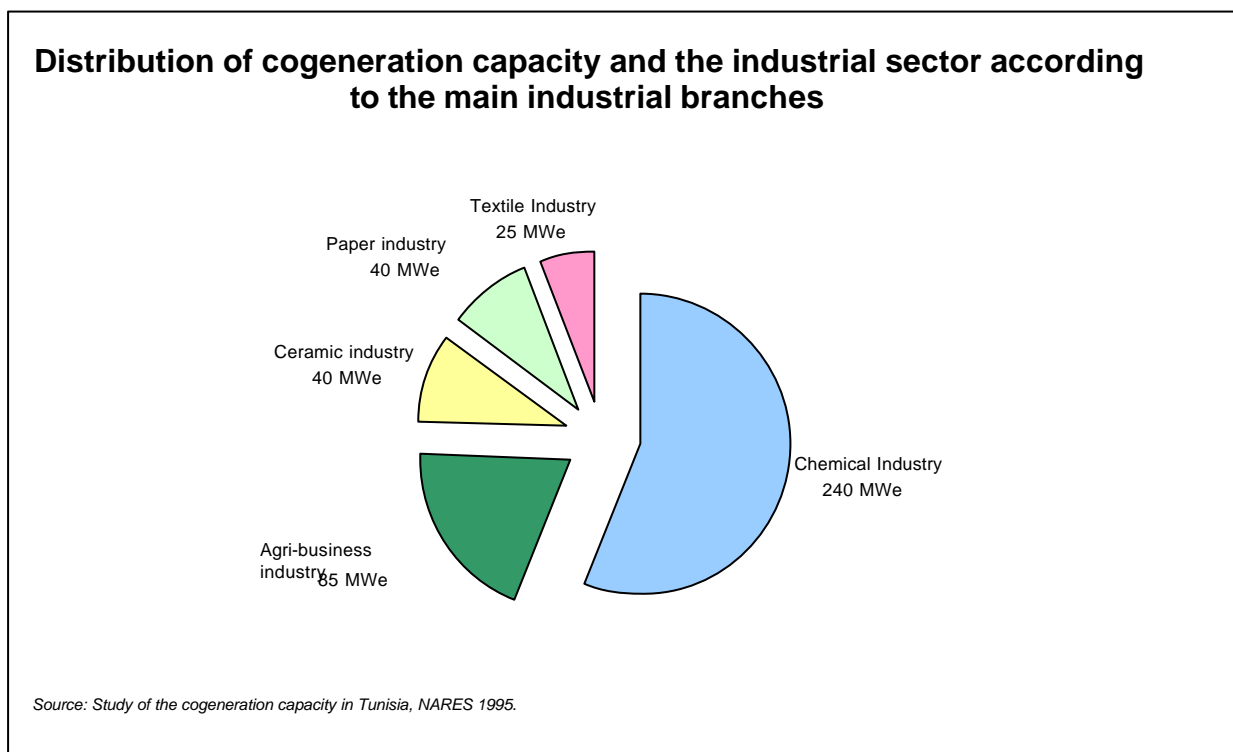
The cogeneration sector is hardly developed in Tunisia. This is due to several reasons, namely the weak diffusion of this technology, an inadequate institutional framework, a capital-intensive barrier due to the high cost of the initial investment, etc... The first and only 5Mwe power-rating cogeneration unit in Tunisia was established in July 2001 by Carthago, a ceramic company.

Recently, within a cooperation framework with Canada, NARES has carried out 9 pre-feasibility studies and 3 feasibility ones in different industrial and service companies.

5.5.2 The section's prospects of development

According to the studies carried out in 1995 by the Spanish Cooperation, the cogeneration capacity that can technically be achieved in Tunisia is of 600 Mwe, 470 Mwe of which are for the industrial sector and 170 Mwe for the tertiary one. In the latter, the deposit concerns large hotels and teaching hospitals. In the industrial sector, the above-mentioned capacity is spread out over 5 main fields, the most important of which is chemical industry, as shown in the pie chart below:

Fig. 3- Distribution of cogeneration capacity in the industrial sector according to the main branches



Necessary measures are being taken by the Tunisian Government to promote this sector and attract private investors. These measures are the following:

- Setting up an appropriate statutory framework in 2002, thus implementing the Presidential decisions.
- Increasing subsidies to 20% of the investment (limited to a maximum of 100,000 dinars, ie 75,000 euros) instead of 5%.
- Setting up an appropriate statutory framework regarding the functioning of cogeneration;
- Capacity building by offering training programmes for technical competences inside public enterprises as well as national consultancy firms.

5.5.3 The industrial and commercial base

The cogeneration section's industrial and commercial base is still in its embryonic stage. However, it is worthwhile mentioning the existence of a few consultancy firms operating in energy control. These firms can be considered as internal competences specialized in the field of cogeneration which is planned to be integrated in the set of energy solutions put forward to operators.

5.5.4 Summary table

Achievements	A 5 Mwe unit at Carthago Céramique A few operations under study
Production	Import
Potential development capacity of the market	600 MW (470 industry – 130 tertiary)
Potential development capacity of the regional market	To be identified
Reference typologies and sizes of installations required by the market	- Industry: 2 to 5 MW with peaks reaching 20 MW - Tertiary: 500 KW to 2 MW
Current incentives and/or planned by government	A 20% subsidy (limited to 100,000 dinars) + other customs and tax incentives

Source: NARES

5.6 Geothermal power

5.6.1 The sector's state of development

Studies appraising geothermal capacity in Tunisia were carried out during the period 1984 – 1986 within the framework of cooperation with Italy (AGIP). The first experiments involved the heating of greenhouses in the South, using water-drilling intended for agribusiness industry.

These experiments were supervised by large-scale schemes set up by the private sector, particularly in the South of Tunisia (KEBILI – DOUZ – EL FAOUAR). Currently, greenhouses heated by low-enthalpy geothermal power lie over an area of 100 hectares.

5.6.2 The section's development prospects

According to the results provided by a strategic study of energy development carried out by NARES in 1996, the development capacity of geothermal power is estimated at about 6,000 ton oil equivalent by the year 2001, which amounts to the heating of greenhouses over 1,000 hectares.

Geothermal power is mostly used in the South and North-West of the country.

5.6.3 The industrial and commercial base

Tunisian operators are active in well-drilling and the supply of pumps and exchangers while national consultancy firms carry out studies to evaluate the existing potential and assess installations.

5.6.4 Summary table.

Achievements	100 hectares of greenhouses heated by low-enthalpy geothermal power
Production	Mixed (local + import)
Potential development capacity of the market	300 + new high-enthalpy projects + water-heating
Potential development capacity of the regional market	To be studied
Reference typologies and sizes of installations required by the market	To be studied
Current incentives and/or planned by government	Financial and tax incentives

APPENDIX 1

*Institutions involved in the sector of renewable
energy sources in Tunisia*

APPENDIX 2

Laws and implementation decrees regarding energy control in Tunisia